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January 5, 1961

Dir

Major General A. D. Starbird  
Director of Military Application  
U.S. Atomic Energy Commission  
Washington 25, D.C.

Dear General Starbird:

As you are aware, Mr. Harold Agnew of the Los Alamos Scientific Laboratory accompanied members of the Joint Committee on Atomic Energy on a tour of the NATO nations involved in one or another aspect of joint custody with the United States of U.S. nuclear weapons. His observations during the course of this tour have led him to prepare the attached memorandum whose specific technical aspects and attachments have been discussed by members of the staffs of our laboratories and have our general concurrence. If you agree with us that this matter seems to be of some urgency and should be pursued further, the LAEL and the SC will be pleased to participate as required.

Very truly yours,

Document transmitted herewith  
contains RESTRICTED DATA

Original Signed by H. E. Bradbury

H. E. Bradbury  
Director, LAEL

ORIGINAL SIGNED BY  
GLENN A. TOWLER

G. P. Schwartz  
President, SC

KER/da

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January 5, 1961

RS 11806  
AM-743

Major General A. D. Starbird, Director  
Division of Military Application  
U. S. Atomic Energy Commission  
Washington 25, D. C.

SUBJECT: NATO WEAPONS

- REFERENCES: (1) SRD Memo, Henderson, SC/McCraw, ALO,  
dtd 2/15/60, RS 1000 (3603), Subject:  
"Extension of Stockpile Life of Mk 7  
and Mk 12 Bombs," with encls: RE 1000  
(3621) and RS 1000 (3622).
- (2) SRD Memo, McCraw, ALO/Starbird, DEA,  
dtd 11/15/60, Symbol: WF:HK HPP:JTB,  
RS 3486/144844, Subject: "Safety of  
the Mk 7 Bomb."

Dear General Starbird:

During December I accompanied members of the Joint Committee on Atomic Energy (JCAE) on a tour of NATO nations. One of the reasons for the visit was to examine the adequacy of the Atomic Energy Act as it affects weapons in our allies' hands. It was apparent that several potentially serious problems may exist under the present arrangements of custody and control of weapons and with the safety of certain weapons we have furnished to the NATO community. After several joint Sandia and LASL discussions I believe it appropriate to make some suggestions for easing both of these problems and to make more sense out of possible requirements for weapons to be used by NATO (or other future assistance programs).

The custody problem, as I understand it, comes about because of inadequacies of the weapons designs when used under the "ready" alert concept adopted by NATO forces. The arrangements necessary for operational reasons penalize the "possession" requirement in the law to the extent that the custody arrangement is merely symbolic and may not be in consonance with the intent of the law.

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by authority of the U. S. D. O. E.,

For JOHNNY ROYBAL 8/28/61  
with authority change in classification (DA  
T O D. I 8/28/61

UNCLASSIFIED

Major General Starbird  
January 8, 1961

RS 11306  
AF-766  
page 2

~~SECRET~~  
UNCLASSIFIED

I have consolidated Sandia and LASL thoughts as to what might be done from a weapon redesign standpoint and believe that some interim solutions are feasible. These considerations are given in Attachment I. Briefly, I would recommend that a coded arming control device be provided in those NATO weapons which must have a ready capability.

If this type of control is deemed desirable it could be provided under normal development and production time scales of 18 to 24 months for WR quality material. On a more urgent basis a limited quantity, sufficient to modify 100 to 200 weapons, could be provided within 9 to 12 months after authorization. This latter possibility would require production priorities and might result in some program interference. Quality of material would be of a development type but of adequate reliability.

In the safety area, I am concerned with the inadequacies of the Mk 7 and Mk 12 bombs when used in a ready alert configuration. In this regard, please refer to the Sandia Corporation letter of February 15, 1960 (Reference 1), and the ALO letter of November 1960 (Reference 2) on the Mk 7 safety problem. It is clear that the addition of trajectory sensing elements to the Mk 7 and Mk 12 fuses should be accomplished if we are to provide a degree of safety similar to that provided in later weapons designed more specifically for the ready alert concept. The latest consideration of retrofitting the Mk 7 and 12 bombs for this capability is given in Attachment II.

Another "safety" concern I have is in the area of dissemination and check of information for weapons used by NATO forces. It is my understanding that no translations of weapon system manuals or drawings are made, leaving the "host" nation to handle the problems of interpretation and translation themselves. This method does not seem consistent with the exhaustive methods the U.S. goes through to insure that the procedural and operational uses of nuclear weapons are well considered from a safety standpoint. A further concern is that of the U.S. handing over obsolete weapons with as many inherent safety problems as are apparent in the Mk 7, for example, to nations whose proficiency in their use does not approach that of the U. S. standards.

All of the above leads us to a further question: Should not weapons which are to be committed to organizations like NATO under the present legal and political restrictions be designed specifically for this purpose? It would seem appropriate that we really study what the true requirements are for the

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Major General Starbird  
January 8, 1961

UNCLASSIFIED

OS 11305  
AW-765  
page 3

NATO weapons and have these considered in the same manner as is done on all other weapons. A present problem facing us (and one which we could presumably do something about in the design state) is use of the TX-57 with the NATO fighter, Fiat G .91. It may be well at this time to consider what the custody arrangements might be for this weapon and to take distinct design steps to allow its use under the legal as well as operational requirements imposed. I believe that these requirements should be spelled out and considered for inclusion into Military Characteristics and, perhaps, Stockpile to Target Sequences.

In summary, I would suggest the following:

1. Add a design feature to deployed NATO nuclear weapons to allow the U.S. to retain "possession" on more than a symbolic basis. The most serious present case, I feel, is the Mk 49 warhead in the Jupiter. Almost as serious is the Mk 7 bomb and warhead. The addition of the Mk 21 and possibly Mk 39 warheads and Mk 28 bombs scheduled for operational use soon in certain of the NATO nations needs attention next.
2. Incorporate safety features in the Mk 7 and Mk 12 bombs to bring them up to the level of present sealed pit system designs. An alternative to this, of course, would be to retire those weapons which are not providing the best capability or the maximum feasible safety due to their obsolescence.
3. Have NATO (or other assistance programs) weapon requirements coordinated and reviewed by the AEC and its design contractors in a manner which is similar to that used for U.S. systems, perhaps incorporating the Phase 1 and Phase 2 concepts. One could logically foresee a modification of weapons now in design or the design of specific weapons to satisfy this purpose.
4. Consider supplying translations of the most important technical manuals to the host country, the translation and preparation of the manuals to be carried out by the U.S.

Believing this matter to be of some urgency, I would like to suggest that you discuss these points with appropriate people in Washington to determine what course of action might be desired. I would be pleased to participate as required.

Very truly yours,

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Harold M. Agnew

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Major General Starbird  
January 6, 1961

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page 4

enc: Attachment I  
Attachment II

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RS 11306  
AW-765  
page 5

#### ATTACHMENT I

### The NATO Custody Control Problem

For some time now, the U.S. has found it desirable to share our nuclear weapons with some of our NATO allies. These weapons have been physically given to these allies except that some key element, usually the capsule, has been retained in U.S. custody. This custody concept is aimed at preventing the use of these weapons without U.S. consent. Recent information indicates that the concepts of custody control now employed may not adequately achieve this aim. Changes to the weapons involved allowing more positive control or possession might help significantly in correcting this situation.

In considering possible weapon modifications, certain general desirable characteristics were postulated. These were:

- (1) The proposed control system should allow flexibility to cover varying degrees of readiness, changing political climates, and changes in weapon employment concepts.
- (2) The changes should not greatly modify our political relations by requiring vast changes in U.S. manpower at the NATO bases or radical new requirements on the allies' security and/or handling procedures.
- (3) The proposed system should be quite difficult to negate in a short time (hours) without an unusual and unlikely degree of intelligence about the system, even if the U.S. custodians are forcibly removed from effectiveness. While the custodians are performing their job, such negation should be extremely difficult.
- (4) The changes should not unduly compromise reaction time after commitment authority has been received.
- (5) The changes should not significantly degrade weapon reliability.

Several possible types of weapon modifications have been considered. Of these, only one appears to adequately meet the characteristics listed above and be reasonably adaptable to the various weapons involved. This one is based on the installation of a coded device in the weapon, which is operated by the U.S. custodian when proper commitment approval has been received. Prior to this operation, the device prevents receipt by the warhead of arming signals, thus preventing detonation.

UNCLASSIFIED

~~SECRET~~

RS 1/1308  
AW-765  
page 6

UNCLASSIFIED

### System Description

A small electronic or electromechanical coded receiver (decoder) would be installed in the weapon in a relatively inaccessible location. This decoder would be connected by a cable to a connector in an accessible part of the weapon, such as on the warhead protective cover or near one of the access doors. A particular, resettable coded signal would be required through this connector to operate the decoder. The output switch of the decoder would interrupt critical arming circuits at any time prior to operation, and would complete these circuits only upon receipt of the proper coded signal.

A quick check of the weapons under consideration indicates that adequate space does exist for such a decoder in inaccessible portions of the weapons. Therefore, once these were installed, they could only be operated (1) by prior knowledge of the code, (2) by randomly applying coded signals to the input until the right code was hit by luck, or (3) by disassembly of the weapon until the decoder could be bypassed. The second method can be essentially ruled out by having enough possible combinations to make the time required intolerably long for any reasonable probability of success. The third method, while possible, first requires an overt act of force; and then the weapon must be disassembled extensively, the decoder recognized and effectively bypassed. Since the decoder would physically be in the warhead, the disassembly, recognition, and bypassing would require considerable knowledge of information not normally available to non-U.S. forces, or else would require much intuitive guesswork with a high probability of failure.

The critical arming circuits to be interrupted would be the inverter to converter circuits and the nuclear arming circuits in capsule type weapons, the high voltage safety switch circuits in high voltage thermal battery type weapons, and the converter input circuits in chopper-converter type weapons. (In addition, to minimize the chances of IFI insertion and the inherent one-point safety problem of inserted capsules, the manual IFI operation feature of the IFI weapons could be disabled.)

### Components

Sandia Corporation now has two designs of potentially suitable remotely controlled coded devices in the prototype stage for other possible uses. These have both been examined for physical, electrical, and system compatibility with the weapons under discussion; and appear adequate. Either of these designs could be developed into usable equipment within reasonable timescales and development costs.

UNCLASSIFIED

~~SECRET~~

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RS 1/1306  
AM-765  
Page 7

Development of three new components would be required: the decoder for installation in the weapon, an encoder for normal operation of the decoder when authorized, and a recoder to change the combination set into the decoder as necessary.

Utilization

Such a system installed in a weapon would be very flexible in its use, through the manner in which the code were handled. Under normal conditions, the code could be set in the weapons by traveling teams, and the code controlled at the highest level desired and transmitted to the custodians with the commitment authorization. Obviously, the code could be controlled at whatever intermediate levels were appropriate to the situation.

The combination could be changed periodically, or when compromise was suspected, or when the level of control needed changing. The combinations used could be unique to each weapon, common in groups, by location or type, or in any desired arrangement, as the overall situation dictated.

Implementation

If such a modification to the NATO-held weapons were found to be necessary, it could be done as a field retrofit on either a crash or a normal timescale, depending on the urgency of the need.

The retrofit would consist of disassembly of the weapon concerned to the degree necessary to install the decoder, installation of the decoder, replacement of existing weapon cables to interconnect the decoder, installation of the cable connecting the decoder to its controlling connector, and reassembly of the weapon. The modifications would involve only the U.S. combat warhead or bomb components.

On a normal basis, Bendia Corporation could supply WR retrofit kits as needed within 18 to 24 months.

On a crash basis, Bendia Corporation could supply reasonable quantities (100-200 sets) of development-type hardware for retrofit within 9 to 12 months of authorization for the Mk 7 and Mk 49 weapons. If necessary the retrofit could be done on-site, using a U.S. traveling team.

Although the 9 to 12 month timescales would not permit full WR type evaluation of the equipment, sufficient evaluation would be done to insure reasonable reliability and quality of the development-type hardware supplied.

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RS 1/1306  
AH-763  
page 8

## ATTACHMENT II

### Safety and Reliability of the Mk 7 Bomb

The Mk 7 bomb as it presently exists in stockpile has several serious reliability problems. In addition, when used in an alert status, the overall safety of the weapon system is significantly below that required of more recent weapons. These problems have been discussed many times in the past, most recently in an SMD memorandum from Mr. E. W. Henderson, Spadix Corporation, to Mr. J. L. McCraw, AIDC, dated February 13, 1960, titled "Extension of Stockpile Life of Mk 7 and Mk 12 Bombs." Recent information indicates that the Mk 7 bomb is, and will continue to be, an important NATO weapon; and that it will be used in an alert status by NATO forces. Under these conditions, both the safety and the reliability of these weapons should be re-examined.

It is felt that additional safing should be added to the Mk 7 bomb by the incorporation of trajectory sensing devices. These devices, which would allow X-unit charging only after the bomb has experienced a normal trajectory, will minimize the chance of an inadvertent nuclear detonation caused by human error or equipment malfunction during handling of these weapons.

Of concern is the probability that such a disaster is potentially more likely in NATO hands due to the language barrier, translation difficulties in written and verbal technical instructions, and the uncertainties of training of these forces. In addition, it is understood that the NATO forces are only allowed FRD information concerning these weapons, and might very well have incomplete or distorted ideas about the functioning of the complete weapon system. In an emergency they may, acting on this partial knowledge, take improper action with these more operationally complex weapons.

For these reasons, it is felt that serious consideration should be given to the retrofit proposed to ease the safety problems associated with the use of the Mk 7 bomb as an alert weapon by NATO forces.

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